REMARKS

Replacement Declaration and Power of Attorney

Applicants are including in Appendix B a replacement Declaration and Power of Attorney that conforms to 37 CFR 1.52 (c).

Allowable Subject Matter

In response to the October 14, 2003 Advisory Action in the above-identified application, applicants submit herewith a Declaration by Dr. Anthony DeVico. In response to the submission of the Declaration by Dr. DeVico, the Office stated that on page 7 of the April 5, 2004 Office Action "Claims limited to the FLSC chimera structure of HIV/CD4 would be allowable." As such applicants have added additional claims 74 to 79 that recite the HIV/CD4 chimera found to be allowable by the Office.

Rejections of Claims and Traversal Thereof

In the April 5, 2004 Office Action,

claims 1-3, 6-8, 10, 11, 24 and 73 were previously rejected and the rejection maintained under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 and 3 of U. S. Patent No. 5,518,723 (DeVico, et al., hereinafter DeVico '723) in view of Chackerian, et al. (Proceedings of the National Academy of Sciences, March 1999);

claims 1-3, 6-8, 10, 11, 24 and 73 were previously rejected and the rejection maintained under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 of U. S. Patent No. 5,843,454 (DeVico, et al., hereinafter DeVico '454) in view of Chackerian, et al.; and

claims 1-3, 6-11, 13-16, 24 and 73 were previously rejected and the rejection maintained under U.S.C. §103(a) as being unpatentable over Chackerian, et al. (Proceedings of the National Academy of Sciences, March 1999) and DeVico '454.

The rejections of the pending claims are hereby traversed, and reconsideration of the patentability of the claims is requested, in light of the ensuing remarks.

Judicially Created Doctrine of Obviousness-type Double Patenting

In response to the maintained rejections under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 and 3 of DeVico '723 and claim 1 of DeVico '454 in view of Chackerian, et al., applicants make the following remarks.

Initially, it should be noted that applicants' claimed invention is a "single chain **polypeptide of peptidic bonds**" that includes:

1) a virus coat polypeptide sequence

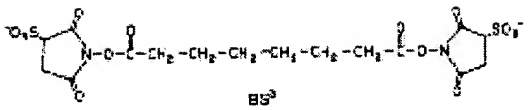
2) a viral receptor polypeptide sequence

3) the viral receptor polypeptide has a bonding affinity for the virus coat polypeptide

4) a spacer peptide that consists of an amino acid sequence that is positioned between the virus coat polypeptide and viral receptor polypeptide to form a single chain polypeptide

5) the spacer is of a sufficient length of amino acid residues to allow the single chain polypeptide to fold thereby permitting the virus coat polypeptide sequence and the viral receptor polypeptide sequence to form an intramolecular interacting complex.

The Office contends that DeVico '454 and '273 in combination with Chackerian, et al render obvious applicants' claimed invention. Applicants vigorously disagree. Reduced to the basics, DeVico '454 and '273 teach just one thing, that being, covalently linking a virus coat receptor protein and a viral receptor protein through the use of a cross-linking agent. The crosslinking agent that is used is bis-sulfosuccinimidyl suberate, a homobifunctional cross-linking reagent with amine reactivity having a structure as set forth below:



BS^3

This crosslinking agent binds **only to primary amines** on the respective proteins, and as such, the complex is entirely different from the chimeras of the presently claimed invention because the end product is not a single chain polypeptide.

The presently claimed invention includes **a peptide spacer** that forms peptide bonds between the terminal α-amino group of one protein and the terminal α-carboxyl group of another protein to form a **single chain polypeptide molecule.**

According to the Office:

> "the specification was consulted to determine if the term "covalently bonded" would exclude the formation of a single chain molecule. Because the specification in DeVico '723 did not define "covalently bonded" to exclude a single chain molecule the term was given its plain meaning in the art; which is a chemical bond, formed between atoms by the sharing of electrons.'

However, applicants submit that even if the term "covalently bonded" is extended to cover a single chain molecule as proposed by the Office, the cited references still do not teach or suggest a **single chain polypeptide**. A single chain molecule that includes a non-peptide crosslinker is not a **single chain polypeptide,** whether covalently bonded or not. The DeVico specification teach

peptide---a non-peptide crosslinker -----peptide.

Further, the DeVico specifications clearly state that the reason for including the crosslinking agent was to ensure integrity of the complexes as stated in the DeVico '723 patent at column 4:

> "We used a covalently linked gp120-CD4 complex as an immunogen. gp120 molecules were covalently coupled to soluble recombinant CD4 using bivalent cross-linking agents to ensure that the integrity of the complexes was maintained during any manipulations." (emphasis added)

Likewise DeVico '454 stated at column 4, lines 47-51, that:

> "We used a covalently linked gp120-CD4 complex as an immunogen. gp120 molecules were covalently coupled to soluble recombinant CD4 using bivalent cross-linking agents to ensure that the integrity of the complexes was maintained during any manipulations." (emphasis added)

Thus, the **covalent cross-linking agent** is essential part of the DeVico invention and the Office is not allowed to extend a meaning to cover embodiments that are not even mentioned or envisioned by the inventor of the DeVico references. The DeVico references described using a cross-linking agent because it was found that using the cross linking agent was the only way to ensure the integrity of the complexes.

Clearly, neither of the DeVico references teaches, suggests or intends to include a single chain **polypeptide**, and in an attempt to remedy the shortcomings of the DeVico references the Office has introduced a secondary reference, Chackerian, et al. However, the combination of Chackerian, et al., and the DeVico references still does not establish a *primary facie* case of obviousness.

Chackerian, et al. relates to a method for disguising self-proteins for recognition as foreign antigens. Chackerian, et al. describes inserting a native self-protein, which is an extracellular (EC) loop of the mouse C-C chemokine receptor CCR5, into the viral capsid (L1) protein from bovine papillomavirus type 1. The chimeras of Chackerian, et al. were constructed by inserting and effectively hiding the mCCR5 sequence within the sequence for L1 capsid, that being the mCCR5 protein was **flanked on both sides by sequences of the L1 protein so that the immune system of the mouse would be tricked into producing self proteins**. Specifically, as stated at page 2372 in column 2 of Chackerian, et al., amino acid residues of the mCCR5 protein were expressed within certain areas of the L1 protein, such as replacing the 130-136, 275-285, or 344-350 amino acids of the L1 sequence. Mice inoculated with chimeric L1-CCR5 particles generated autoantibodies that bound to native mouse CCR5, inhibited binding of its ligand RANTES, and blocked HIV-1. As stated by the Chackerian, et al. group, the results demonstrated that adult mammals retain the capacity to produce antibodies specific for a self-antigen, provided that the antigen is presented in a context in which the

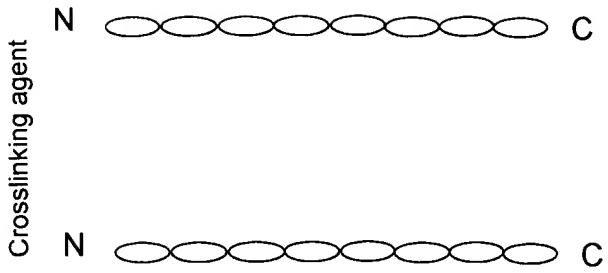
host does not recognize it as self. Thus, the reason for the experiments set forth in the Chackerian, et al. reference was to generate antibodies specific for the exposed CCR5 epitope.

Reduced to the basics even if the proposed combination was feasible, the combination still does not teach each and every element of applicants' claimed invention. The following table clearly illustrates this point.

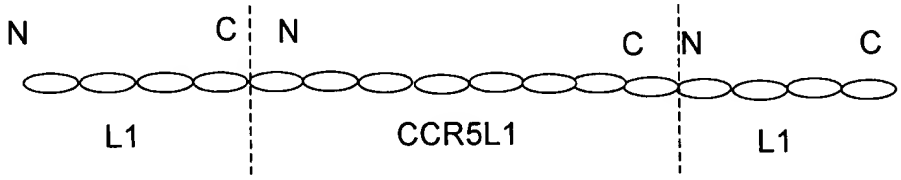
Elements of Claimed Invention	Present Invention	DeVico '454 and'723	Chackerian
1) a virus coat polypeptide sequence	YES	YES	YES
2) a viral receptor polypeptide sequence	YES	YES	YES
3) the viral receptor polypeptide has a **bonding affinity** for the virus coat polypeptide	YES	YES	NO
4) **a spacer peptide** that consists of an amino acid sequence positioned between the virus coat polypeptide and viral receptor polypeptide to form **a single chain polypeptide**	YES	NO	NO
5) the spacer is of **a sufficient length of amino acid residues to allow the single chain polypeptide to fold** thereby permitting the virus coat polypeptide sequence and the viral receptor polypeptide sequence to form an **intramolecular interacting complex.**	YES	NO	NO

After a review of the element of the presently claimed invention, it is evident that the proposed combination does not in any teach or suggest all the elements of applicants' claimed invention and it would not be obvious from the proposed combination to go in the direction of applicants' without applicants' specification which is impermissible hindsight. Clearly, neither reference teaches or suggests **a spacer peptide** that consists of an amino acid sequence positioned between the virus coat polypeptide and viral receptor polypeptide to form **a single chain polypeptide.**

The DeVico references teach two polypeptides that are bound together by **a crosslinking agent attached to the amino ends of each protein** and as such there is no spacer that provides for a single **polypeptide** chain.



The Chackerian, et al. reference teaches a polypeptide but there is no discussion or teaching in the reference to provide a spacer sequence consisting of amino acid residues positioned between the L1 sequences and the CCR5 sequence because the CCR5 sequence is inserted within the L1 sequence.



Thus, neither reference teaches or suggests applicants' claimed invention, and the Office has not provided any suggestion in either reference to show a spacer sequence consisting of amino acid residues positioned between the virus coat peptide and viral receptor sequence.

Applicants submit that the single chain polypeptide of the present invention is not an obvious extension of the DeVico '723 or '454 patents in combination with Chackerian, et al., and the Office has not provided any objection evidence to establish such obviousness. The Office should be aware that the Federal Circuit recently addressed the question whether there is a reason to combine references and what is required by the examiner to show a suggestion to combine references and stated: (See *In re Lee*, 61 USPQ3d 1430, 1433 (Fed. Cir. 2002))

> '"The factual inquiry whether to combine references must be thorough and searching.' *Id.* It must be based on **objective evidence of record**. This precedent has been reinforced in myriad decisions, and **cannot** be dispensed with. *See, e.g., Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1124-25, 56 USPQ2d 1456, 1459 (Fed. Cir. 2000) ("a showing of a suggestion, teaching, or motivation to combine the prior art references is an `essential component of an obviousness holding"') (quoting *C.R. Bard, Inc., v. M3 Systems, Inc.*, 157 F.3d 1340, 1352, 48 USPQ2d 1225,1232 (Fed. Cir. 1998)); *In re Dembiczak*, 175 F.3d 994, 999, 50

> USPQ2d 1614, 1617 (Fed. Cir. 1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-**based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references**."); *In re Dance*, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998) (there must be some motivation, **suggestion,** or teaching of **the desirability** of making the specific combination that was made by the applicant); *In re Fine*, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988) ("'teachings of references can be combined *only* if there is some suggestion or incentive to do so.'") (emphasis in original) (quoting *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984)).
>
> **The need for specificity pervades this authority**. *See, e.g., In re Kotzab*, 217 F.3d 1365, 1371, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) ("particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected **these components for combination in the manner claimed**"); *In re Rouffet*, 149 F.3d 1350, 1359, 47 USPQ2d 1453, 1459 (Fed. Cir. 1998) ("even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill, that suggests the claimed combination.
>
> In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious."); *In re Fritch*, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992) (the examiner can satisfy the burden of showing obviousness of the combination "**only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references**")." (Emphasis added)

Reading the above quote, it is apparent that the Federal Circuit in 2002 has raised the bar that the Office must meet to show a suggestion or motivation to combine references to establish a *prima facie* case of obviousness. Applicants submit that the Office has not met the current standard set forth by the Federal Circuit to show a suggestion or motivation to combine the cited references. Clearly, the Chackerian, et al polypeptide has been constructed to produce a polypeptide wherein the CCR5 epitope is exposed and the Chackerian, et al. group did not want this epitope to bind to the L1 sequence for the specific reason that they wanted the CCR5 epitope exposed, and as such, there is no reason or guidance to take the Chackerian polypeptide(even though there is no spacer) and miraculously motivate one skilled in the art to have the CCR5 epitope bind to the L1 sequence. Clearly, this binding would defeat the purpose of Chackerian, et al. which requires that the CCR5 epitope be exposed and antigenic for production of antibodies.

Further, the Chackerian, et al. reference is not competent prior art because applicants made the present invention before the effective date of March 3, 1999 as attested by the inventors in the enclosed Declaration under 37 CFR §1.131. The Declaration attests to facts showing that the claimed

invention was made by the applicants before the effective date of the cited reference relied on by the Office to show that the present invention was obvious and at the time the present invention was made the subject matter as a whole would not have been obvious.

The Declaration includes appended Exhibit 1 which is a copy which is a true and exact copy of pages 1-3 of an Invention Disclosure Document, on which all dates have been blacked out, but which dates are prior to the Effective Date; that page 1 identifies co-inventors identifies co-inventors Anthony L. DeVico, Timothy R. Fouts and Robert G. Tuskan, that the title of the document is "Single chain HIV gp120-CD4 chimeric complexes as anti-HIV immunogens and therapeutics," that page 2, second paragraph, second last sentence discusses the "the CD4 and gp120 are linked by 20 amino acid spacer between the C-terminus of gp120 and(derived from the HIV-1 isolate BaL) and the N-terminus of the first two Ig domains of human CD4"; that page 2, under Section 3 discusses the production of the single chain chimeric complex and that in fact the "single chain protein folded into a conformationally altered state indicative of gp120-CD4 complex formation.

Thus, the declaration shows possession of the single chain chimeric polypeptides disclosed and claimed by applicants prior to the effective Date of Chackerian, et al. Accordingly, applicants respectfully request the withdrawal of the rejection of claims 1-3, 6-8, 10, 11, 24 and 73 under the judicially created doctrine of obviousness-type double patenting over DeVico '723 or '454 in view of in view of Chackerian, et al.

Rejection under 35 U.S.C. §103 (a)

Claims 1-3, 6-11, 13-16, 24 and 73 was previously rejected and maintained under U.S.C. §103(a) as being unpatentable over Chackerian, et al. and DeVico '454. Applicants traverse such rejection.

As stated above, Chackerian, et al. relates to a method for disguising self-proteins for recognition as foreign antigens. Chackerian, et al. suggests that antigen arrangement may be a major determinant in inducing B cell responsiveness to self proteins and discusses the importance of an ordered array of the antigen in the whole viron. The reference describes inserting a native self protein as part of a highly organized array of an assembled viral capsomer that can induce production of autoantibodies against the native self-protein. Chackerian, et al. accomplished this purpose by inserting a self-peptide, which

was an extracellular (EC) loop of the mouse C-C chemokine receptor CCR5, into the viral capsid (L1) protein from bovine papillomavirus type 1. The bovine papillomavirus has the intrinsic capacity to self-assemble into virus like particles that induce high levels of neutralizing antibodies.

Initially, it should be noted that there is no teaching or suggestion that the self-protein and the viral capsid protein have any affinity for binding to each other when they are combined into the chimeric polypeptide. According to the Office, the present specification does not specifically describe bonding affinity and that it is given the broadest scope which includes low and high bonding affinity. Thus according to the Office, the L1-CCR5 chimeric of Chackerian, et al. may have bonding affinity and the Office requested that applicants determine the type of bonding affinity that is present between the L1 sequence and the CCR5 sequence. Applicants should not be required to show whether the L1 and CCR5 proteins have some level of inherent bonding because it is well settled in the law that inherency is not a standard applied in an obviousness rejection. That which is unknown cannot possibly be obvious. Clearly, the Chackerian, et al. reference is completely silent on bonding between the two protein sections but it is very evident that the purpose of the Chackerian, et al reference is to generate antibodies to the exposed CCR5 sequence and if this sequence is hidden in a bonding structure then it will be very difficult to produce antibodies specific for the CCR5 sequence.

> The Office has made the statement that the tertiary structure is important and that antibodies are not produced when the L1-CCR5 protein was denatured. The Office and applicants recognize that there is a large difference between the primary structure of a string of amino acids and the folded tertiary structure. However, it is pure speculation on the part of the Office to suggest that the L1 and CCR5 sequences have receptor-ligand bonding affinity when assembled in the tertiary structure.

However, obviousness cannot be predicated on what is not known at the time an invention is made, even if the inherency of a certain feature is later established. I*n re Rijckaert,* 28 USPQ2d 1955 (Fed. Cir. 1993). Here the bonding affinity between the two protein was unknown. Therefore, how could a skilled artisan make any modification of Chackerian, et al. to arrive at the present invention which possesses heretofore unknown elements. While it is possible that, serendipitously, the Chackerian, et al. L1-CCR5 protein may have such a feature, serendipity is not a valid basis for asserting obviousness.

The Office recognizes that Chackerian, et al. does not teach a chimera of a retrovirus coat protein and a viral receptor protein linked by spacer amino acids. To overcome the deficiencies of the Chackerian, et al. reference, the Office introduced the DeVico '454 reference because according to the Office, "DeVico, et al. disclose in both patents a CD4-gp120 complex that have been covalently linked using a reactive spacer molecule." However, the Office is completely ignoring the fact that applicants' claimed invention includes elements not disclosed or described by any of the cited references. Where in the proposed combination is there any teaching or suggestion of using an amino acid spacer positioned between the viral receptor protein and the virus envelope protein? Clearly there is no disclosure and the Office cannot conjure up these elements by expanding the meaning of terms in either of the cited references.

However, the Office contends that:

> "it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a chimera for the production of the gp120-CD4 complex. . . . One of ordinary skill in the art would have the high expectation of success when expressing the complex as a single polypeptide. The addition of amino acid linkers would have been obvious to the ordinary artisan in order to alleviate potential folding constraints in the chimera."

As stated above, the Lee Board has been very specific regarding the level of evidence that the Office is expected to provide in establishing a prima facie case of obviousness. The Office has not met this standard.

As stated numerous times:

1) Neither reference teaches or suggests going in the direction of applicants' claimed invention, which uses an amino acid spacer positioned between the virus coat protein and the viral receptor protein to allow the single chain polypeptide to fold and form an intramolecular interacting complex.

2) There is no motivation put forth in either reference to insert amino acid sequence between the different peptides of either reference to form a single chain polypeptide molecule. As the Office expressly stated in the Office Action of October 22, 2002 that "[t]he reference makes no discussion of

using spacer amino acid yet the chimera is able to form the requisite tertiary structure indicating that a spacer is not required for the structure." If the Chackerian, at al. capsid reassembles properly where is there any motivation to go in the direction of applicants' claimed invention?

3) The DeVico '454 reference does not provide any motivation to form a single chain polypeptide that includes the virus coat polypeptide sequence and the viral receptor polypeptide separated by an amino acid spacer. Instead, DeVico '454 stresses the importance of **covalently bonding** the gp120 protein directly to the CD4 receptor protein with a cross-linking agent to ensure that the two soluble proteins are not separated when in use. DeVico '454 discusses that the prior art used natural affinity bonding and then that "the complexes used in these studies were unstable and comprised noncovalently bound gp120 and CD4." To overcome the shortcomings of the discussed prior art, DeVico '454, as stated at column 4, lines 46-51, "used a covalently linked gp120-CD4 complex as an immunogen. gp120 was covalently coupled to soluble recombinant CD4 using bivalent cross-linking agents to ensure that the integrity of the complexes was maintained during any manipulations."

4) There is no motivation or incentive in DeVico '454 to replace the bivalent cross-linking agents with an amino acid spacer, such as used in the presently claimed invention. Nor is there any indication that such a complex would be effective. Instead, DeVico '454 teaches that forming a noncovalently bonded complex has several inherent problems such as the two soluble proteins becoming uncomplexed and this was the impetus for DeVico '454 to form a covalent bond between the gp120 and the CD4 by crosslinking the two soluble proteins together.

5) DeVico '454 requires crosslinking because as stated numerous times in the reference, covalent bonding of the gp120 protein to the CD4 by crosslinking is very important to maintain the integrity of the complex. There is no suggestion to produce a complex between the receptor and ligand pair that is not covalently bonded because of the cited problems with complexes that were not covalently bonded. Applicants suggest that if the DeVico '454 crosslinked complexes were made according to the methods described by Chackerian, et al. then the DeVico '454 complexes would no longer be chemically crosslinked and thus would not function as intended. According to the court in *In re Gordon,* 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984), if proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. Further, if the L1 and CCR5 of the Chackerian, et

al. reference were covalently complexed together into a receptor-ligand complex hiding the CCR5 sequence then the Chackerian, et al chimeric would no longer function as intended and the antigenic CCR5 would be hidden and antibodies to the self protein would likely not be generated.

6) The Office has not identified any objective or specific teachings or suggestions in the cited references that would motivate one skilled in the art to combine the references. Neither reference uses an amino acid spacer, Chackerian, et al. does not teach or suggest a receptor/ligand pair but instead inserting self proteins in a viral capsid protein in an acceptable order to trick the body into believing that the self protein is in fact a foreign antigen and DeVico '454 teaches the importance of chemically crosslinking two soluble proteins into a covalently bonded complex. Surely one skilled in the art would never consider uncrosslinking the DeVico '454 complex and combining the two soluble proteins into the Chackerian, et al. arrangement and then somehow determine that an amino acid sequence of a sufficient length positioned between the two proteins would allow for a stable complex, absent a reading of applicants' present application. Thus, the Office seems to be merely reinterpreting the prior art in light of applicants' disclosure, in order to reconstruct applicants' claimed invention, but without any instructional or motivating basis in the references themselves. Such approach is improper and legally insufficient to establish any *prima facie* case of obviousness.

7) The Chackerian, et al. reference is not competent prior art because applicants made the present invention before the effective date of March 3, 1999 as attested by the inventors in the enclosed Declaration under 37 CFR §1.131. The Declaration attests to facts showing that the claimed invention was made by the applicants before the effective date of the cited reference relied on by the Office to show that the present invention was obvious and at the time the present invention was made the subject matter as a whole would not have been obvious.

In light of the above discussion and the fact that the Office has not met its burden of establishing a *prima facie* case of obviousness, applicant requests that the rejection of claims 1-3, 6-11, 13-16, 24 and 73 on the basis of obviousness, be withdrawn.

Request for Rejoinder Reminder

The Office is respectfully reminded that applicants previously requested rejoinder of method claims 34, 46, 49-57 and 60-65 upon allowance of the product claims. Towards that end, withdrawn method claims have been amended in a manner consistent with the pending composition claims.

Such rejoinder would be fully proper under these circumstances, for the following reasons:

When an application as originally filed discloses a product and the process for making and/or using such product, and only the claims directed to the product are presented for examination, when a product claim is found allowable, applicant may present claims directed to the process of making and/or using the patentable product for examination through rejoinder procedure in accordance with MPEP §821.04, provided that the process claims depend from or include all the limitations of the allowed product claims.

Fee Payable and Petition for Two-Month Extension

Applicants have added 6 new claims, one of which is an independent claim. However, applicants cancelled independent claim 66 and dependent claims 67-72 in an early response and as such no new fee is due for the newly added claims.

Applicants hereby petition for a two month extension of time, extending the deadline for responding to the April 5, 2004 Office Action from July 5, 2004 to September 5, 2004. The entry of this petition results in a petition fee of $210.00. A credit card form in the amount of $390.00 is submitted including a $180.00 fee for the Supplemental IDS and the $210.00 fee for the extension. Authorization is hereby given to charge any deficiency in applicable fees for this response to Deposit Account Number 08-3284 of Intellectual Property/Technology Law.

Conclusion

Applicants have satisfied all the requirements for patentability. All pending claims are free of the art and fully comply with the requirements of 35 U.S.C. §112. It therefore is requested that Examiner Winkler reconsider the patentability of claims 1-3, 6-11, 13-16, 24 and 74-79 in light of the distinguishing remarks herein and withdraw all rejections, thereby placing the application in condition

for allowance. Notice of the same is earnestly solicited. In the event that any issues remain, Examiner Winkler is requested to contact the undersigned attorney at (919) 419-9350 to resolve same.

Respectfully submitted,

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